SPACE Meets Sand At Lucky Sentinel

Major Terry Torraca, U.S. Army

WARFIGHTERS ARE DEPLOYED in the dirt, in the mud, and recently, in the case of the U.S. Army Forces, U.S. Central Command (ARCENT), in the sand. Bringing space to the sand were two elements of the U.S. Army Space Command (ARSPACE)—the Army space support team (ARSST) from 1st Space Battalion, Colorado Springs, Colorado, and the space operations officer permanently assigned to the ARCENT staff.

Just how important is space to our national and global interests? The 11 January 2001 Report of the Commission to Assess U.S. National Security, Space Management, and Organization states: "The security and economic well being of the United States and its allies and friends depends on the nation's ability to operate successfully in space. To be able to contribute to peace and stability in a distinctly different but still dangerous and complex global environment, the United States needs to remain at the forefront in space, technologically and operationally, as we have in the air, on land, and at sea. Specifically, the nation must have the capability to use space as an integral part of its ability to manage crises, deter conflicts, and, if deterrence fails, to prevail in conflict."

ARSPACE, U.S. Space Command (USSPACECOM), and U.S. Army Space and Missile Defense Command (USASMDC) lead the Army's efforts in harnessing this evolutionary component of battlespace. ARSPACE supports warfighters in several areas, including the Defense Satellite Communications System (DSCS), theater missile defense, and overall space support. The ARSSTs and the space officers who lead them provide space support directly to warfighters. Their efforts in Lucky Sentinel 01 clearly demonstrated progress in the continuing process of integrating space into operations.

The ARSST is the primary force-projection resource for ARSPACE. ARSSTs provide space support to various echelons, ranging from the land component commander to special operations forces teams. ARSSTs provide rapidly deployable space-based operational support across the spectrum of military and civil operations. The teams are organized identically to support the corps; however, their organization is routinely modified to meet mission requirements. Narrowly defined, ARSSTs assess the capabilities, limitations, and status of space-based systems as they apply to the tactical situation. Applied operationally, the teams perform space assessment, fully exploit space force enhancements, and provide commercial imagery and terrain products to the supported commander. Leading each ARSST is a new breed of officer—the functional area (FA) 40, space operations officer.

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To fully integrate space capabilities, Transformation forces will need space-literate personnel who can provide enhanced access to information derived from military, national, and commercial space segments. In 2000, the Army established FA 40 to provide a career path for officers specializing in space literacy. These officers provide space expertise to tactical, operational, and strategic staffs and articulate Army space requirements and capabilities in both joint and national forums. There are several categories of positions for space operations officers, ranging from joint positions at USSPACECOM

US Army

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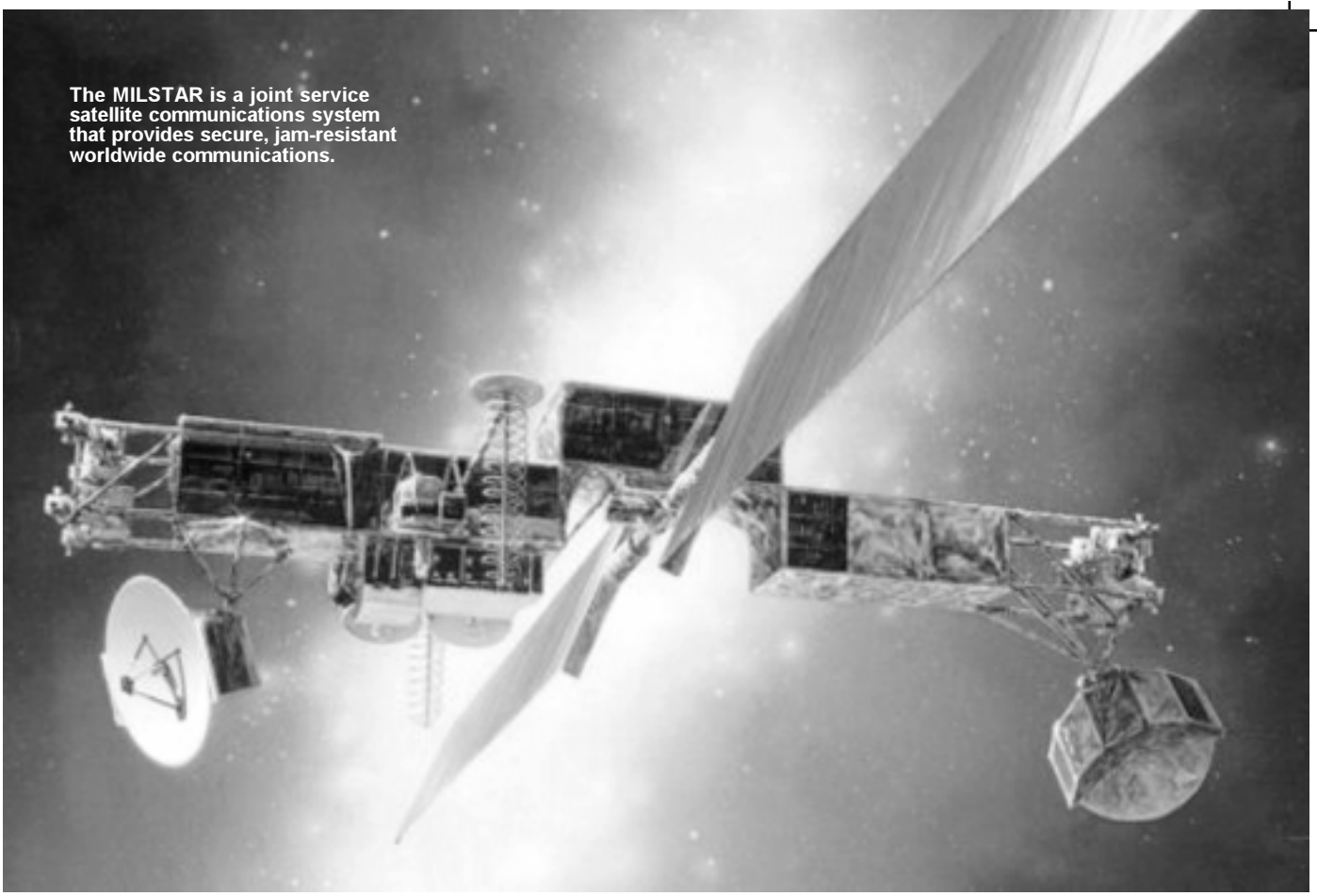
to Army positions at USASMDC, ARSPACE, the National Aeronautical and Space Administration, and one at each corps- and Army-level headquarters. As the two critical elements in integrating space, the ARSST and resident space operations officer were brought together as a space cell to support Third U.S. Army, ARCENT, during Lucky Sentinel 01.

Lucky Sentinel is an annual exercise held in Kuwait in early April. It is designed to improve readiness and demonstrate U.S. commitment to the Gulf region's security and stability. The resident space operations officer, who has been assigned to the command for approximately eight months, and an ARSST that deployed from Colorado Springs provide the space support. The space operations officer assigned to the ARCENT staff is aligned with the C5/J3 plans section. By being assigned to the plans section, the space operations officer stays abreast of current operations, participates in the military decisionmaking process (MDMP), and provides space-related information during future plan development. The space operations officer also oversees all staff sections through routine planning meetings and ongoing contact with each primary staff section through its representative within the operations planning group. The ARSST is collocated with the resident space operations officer to facilitate support operations. This organization of space elements and capabilities proved efficient during the execution of Lucky Sentinel and overall space support operations.

During Lucky Sentinel, the resident space operations officer and ARSST provided space awareness, expertise, products, and analysis to the ARCENT commander and his staff. U.S. Army Field Manual (FM) 100-18, *Space Support to Army Operations*, describes the mission, architecture, characteristics, and applicability of space resources to support Army operations. The team provided support in five proven space force-enhancement areas: position and navigation; communications; missile warning; reconnaissance, intelligence, surveillance, and target acquisition (RISTA); and weather, terrain, and environmental monitoring (WTEM). The team also contributed to intelligence preparation of the battlefield (IPB) by providing and continually updating a space intelligence estimate and responding to space-related requests for information.

Position and navigation. The ARSST produces graphs 72 hours in advance for a given 24-hour period that depict the predicted accuracy of systems that rely on global positioning systems (GPS). Currently, there are several joint computer applications that produce these graphs, including space battle management cores systems and the operational model to exploit GPS accuracy. The graphs show time along the horizontal axis and predicted GPS error along the vertical axis. The GPS error can be displayed in different units of measurement, depending on the command's requirements; however, the most common errors depicted are spherical error of probability and circular error of probability, both given in meters. Data shown on these graphs are potentially crucial to critical navigation and precision-guided munitions systems. The rule of thumb is "don't strike during the spike," which is when the predicted error is highest. The graphs show predicted accuracy of systems that rely on GPS, the



The MILSTAR is a joint service satellite communications system that provides secure, jam-resistant worldwide communications.

DOD

The space weather phenomenon is based on solar bursts and occurrences in the Earth's ionosphere. Systems that are most vulnerable to these events include ultrahigh frequency and super high frequency SATCOM and radar, but space weather may also affect navigation and intelligence systems. The extremely high frequency band supported by the military strategic and tactical relay (MILSTAR) constellation is the least vulnerable to space weather, jamming, and nuclear electromagnetic pulse.

health and status of individual satellites within a constellation, the geometry of the constellation, and predicted error based on a given location in the world.

In general, lowered GPS accuracy mostly affects guided munitions, deep attack operations, and ground maneuver during low visibility or in a desert environment. The ARSST first provides GPS accuracy information to the G3, current operations. This enables the current operations staff to disseminate information quickly and immediately mitigate the risk to ongoing operations. Likewise, the deep operations coordination cell uses the information to mitigate the risk to ongoing deep operations, to assess impact to near-term operations, and to identify limitations during planning for future deep operations. Other staff sections, such as logistics and intelligence, use the information to counter possible effects of degraded GPS accuracy.

Communications. The ARSST monitors the status of all satellite communications (SATCOM) systems. This service can be as general as learning a constellation's health status or as specific as frequencies affected by adverse solar weather. The team can also act as a liaison between the supported unit and ARSPACE assets worldwide, including the DSCS regional signals intelligence support center and DSCS operations center for SATCOM. This allows the team to help the G6 address issues directly related to the DSCS SATCOM constellation. The team also provides an early entry communications capability with international maritime satellite telephone terminals.

ARSST communications support also helps the G6 by determining which satellites support the communications network, tracking the status of satellites down to the channel level, assisting in resolving issues with support, requesting activation of residual or marginal capabilities, and identifying scheduled and unscheduled outages.

Missile warning. The ARSST maintains an operational knowledge of the theater event system and the joint tactical ground station (JTAGS) component for theater ballistic missile early warning. This includes probability of detection, ellipses for predicted

impact points, and deployed elements' daily status. The ARSST can assist the supported unit in troubleshooting early warning networks, optimizing coverage, and assessing early warning system limitations. There are three early warning systems that comprise the theater event system—the National Tactical Detection and Reporting System, JTAGS, and the U.S. Air Force's Attack and Launch Early Reporting to Theater System. JTAGS is the U.S. Army and U.S. Navy's deployable shelter that deployed forces use in theater. It injects data directly into the theater's tactical computer applications, the theater data distribution system, and the tactical information broadcast service network to disseminate the earliest possible warning to U.S. troops. This is a distinct advantage over other early warning systems.

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The ARSST missile warning support enhances the efforts of the unit's air defense element. It tracks the operational status of both JTAGS and Defense Satellite Program (DSP) satellites. These systems are key to providing early warning beyond the limits of ground-based systems. The team will also coordinate the optimization of DSP coverage for mission requirements.

RISTA. The ARSST deploys with a joint software application called the satellite and missile analysis tool that simulates Earth-orbiting objects and satellites in near real time. The team uses the tool to create text or graphical reports that help staff sections use satellite reconnaissance advance notice data. This data provides information on potential threat satellites and their capabilities to monitor friendly operations.

ARSST RISTA support affects the unit's operational security, deception planning, and battle damage assessment (BDA). The ARSST will determine the unit's vulnerability to enemy collection by using space-based systems and will identify both passive and active countermeasures. This information is also useful in planning and executing deception operations. The team will also use information from friendly systems to facilitate using commercial imagery for general requirements and BDA.

WTEM. The team monitors space weather, assesses its impact on current operations, and advises the command on methods to counter effects. Space weather has the potential to affect many Department of Defense systems. The space weather phenomenon is based on solar bursts and occurrences in the Earth's ionosphere. Systems that are most vulnerable to these events include ultrahigh frequency and super high frequency SATCOM and radar, but space weather may also affect navigation and intelligence systems. The extremely high frequency band supported by the military strategic and tactical relay (MILSTAR) constellation is the least vulnerable to space weather, jamming, and nuclear electromagnetic pulse.

Also part of WTEM is the team's ability to produce both two- and three-dimensional satellite-imagery products using panchromatic, multispectral, and hyperspectral imagery. The ARSST can reach back to the Multi-Spectral Imagery Lab in Colorado Springs, Colorado to fill shortfalls by providing additional imagery requirements, scene rectification, and hard- and soft-copy production. The facility's digital imagery processing capabilities include multispectral and hyperspectral radar; creating and editing digital elevation data; and integrated geographic information systems processing. The team deploys with preloaded data sets that include archived national and commercial imagery. Two-dimensional imagery products are produced using IMAGINE software published by Earth Resources Data Analysis System. These products may vary in resolution from 1 to 30 meters and may be nadir or perspective views. This two-dimensional imagery may be imported into another software program—Edge, published by Autometric—to create a three-dimensional animated fly-through. These flights may be generated along a predefined route on the ground or from various perspectives such as for an air IPB. Fly-throughs can be created for various speeds and altitudes, and they can be exported to a compact disk-read only memory, an 8-millimeter tape, or a vertical helix scan (VHS) tape for the supported unit to replay later.

The ARSST has a limited but unique ability to predict and assess space weather effects on the supported units' operations. This ability is essential to ensuring communications support to critical opera-

The deep operations coordination cell synchronizes the employment of guided munitions, deep attack operations, and ground maneuver.

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tions and establishing countermeasures to solar weather effects. In the area of imagery support, the ARSST enhances the unit's topographical team by increasing its production capability. The team also assists in retrieving current and archived imagery. This improves the quality of the warfighter's imagery and expands the distribution of imagery within the staff.

During Lucky Sentinel, the support described in the five space force-enhancement areas proved to be a combat multiplier to the ARCENT staff and helped develop key information for the MDMP. The warfighter's requirements continually change the type of space support provided, the space support doctrine, and the tools used to develop the support.

Space operations enhance combat operations and play an increasingly critical role in ensuring U.S. military forces can see, shape, and dominate the battlespace in the coming decades. In truth, the Army cannot achieve the Objective Force's characteristics or its Transformation goals without fully exploiting space. Space assets provide capabilities to a rapidly moving force while minimizing the logistics tail and deployed infrastructure. Today, space assets deploy where needed and when needed. Tomorrow, space assets must respond to the highly mobile warfighter and be tailored to the Objective Force's needs. Only through the continued efforts of all space operations elements can space-based products enable warfighting. Lucky Sentinel 01 proved that timely, accurate space products can ensure warfighters' success. The 1st Space Battalion, USSPACECOM, brings space to the warfighter. ***MR***

Major Terry Torraca, U.S. Army, is currently team leader, V Corps Army Space Support Team, Army Space Support Company, 1st Space Battalion, U.S. Space Command, Colorado Springs, Colorado. He received a B.S. from Florida Institute of Technology. He previously served as commander, Headquarters and Headquarters Company, 1-12 Field Artillery (FA) Battalion (Multiple-Launch Rocket System), Fort Sill, Oklahoma; brigade signal officer, 17th FA Brigade, Fort Sill; and executive officer, Headquarters and Headquarters Company, 123d Signal Battalion, Kitzingen, Germany.